

I. C. 7518

easily convertible to very volatile product, and up to 65 percent is converted to oil distillable below 200° C. at 2 mm. Hg (for an initial H₂ pressure of 1,500 p.s.i.g.). From this point of view, gilsonite would seem to be an excellent source of liquid fuels; unfortunately, the total reserves of gilsonite amount to only about 0.5 percent of the annual production of petroleum in the United States.

Analyses were made for carbon and hydrogen on the benzene-insoluble asphalt and oil products from various runs, and the results are listed in table 22.

TABLE 22. - Ultimate analyses on products

Run No.	Nature of product	Carbon, percent	Hydrogen, percent	Cl, percent
749	Benzene-insoluble	75.00	4.22	-
	Asphalt	85.03	7.19	-
	Oil	85.71	11.86	-
750	Benzene-insoluble	83.46	4.31	0.89
	Asphalt	86.27	7.48	.07
	Oil	86.57	11.46	.04

The low percentage of carbon for the benzene insolubles of run 749 is due to the ash (Sn) content. In general, the carbon and hydrogen contents of the three fractions are those which might be expected from the solubility characteristics. Of interest is the low Cl content of the oil and asphalt from run 750, in which only NH₄Cl was added as catalyst. This indicates that although NH₄Cl (or HCl) may act to split asphalt, at least in the case of gilsonite, only a very small quantity of Cl, at most, is chemically bound with the soluble products after hydrogenation. The Cl found in the benzene-insoluble product from run 750 is equivalent to only one-third of the Cl added as NH₄Cl, and it is almost exactly equivalent to the ash (taken as CaO) present in the original gilsonite.

Pilot-Plant-Scale Experimentation

The pilot plants, one for the first or liquid-phase stage and one for catalyst testing in the second or vapor-phase stage are being completed. Some views of the liquid-phase plant are shown in figure 50, hydrogen compressor valve, manifold (fig. 51) view of high-pressure liquid and paste pumps (fig. 52), liquid-phase reactors (fig. 53), feed and product control valves, and off-gas scrubbers for ammonia, hydrogen sulfide and hydrocarbons.

A series of runs was completed on production of heavy fuel oil in the liquid-phase coal hydrogenation plant. A mathematical analysis of the sampling problem in plants such as the coal hydrogenation pilot plant was made.^{130/}

Demonstration-Plant Construction

Under construction at the Missouri Ordnance Works site at Louisiana, Mo., is a 200- to 300-bbl.-per-day Coal-Hydrogenation Demonstration Plant. Architectural and engineering-design work and 98 percent of the construction are completed.

^{130/} Kandiner, H. J., Sampling Lag and Purging Time in Mixing Vessels in Series: Chem. Eng. Progress, vol. 44, 1948, pp. 383-386.

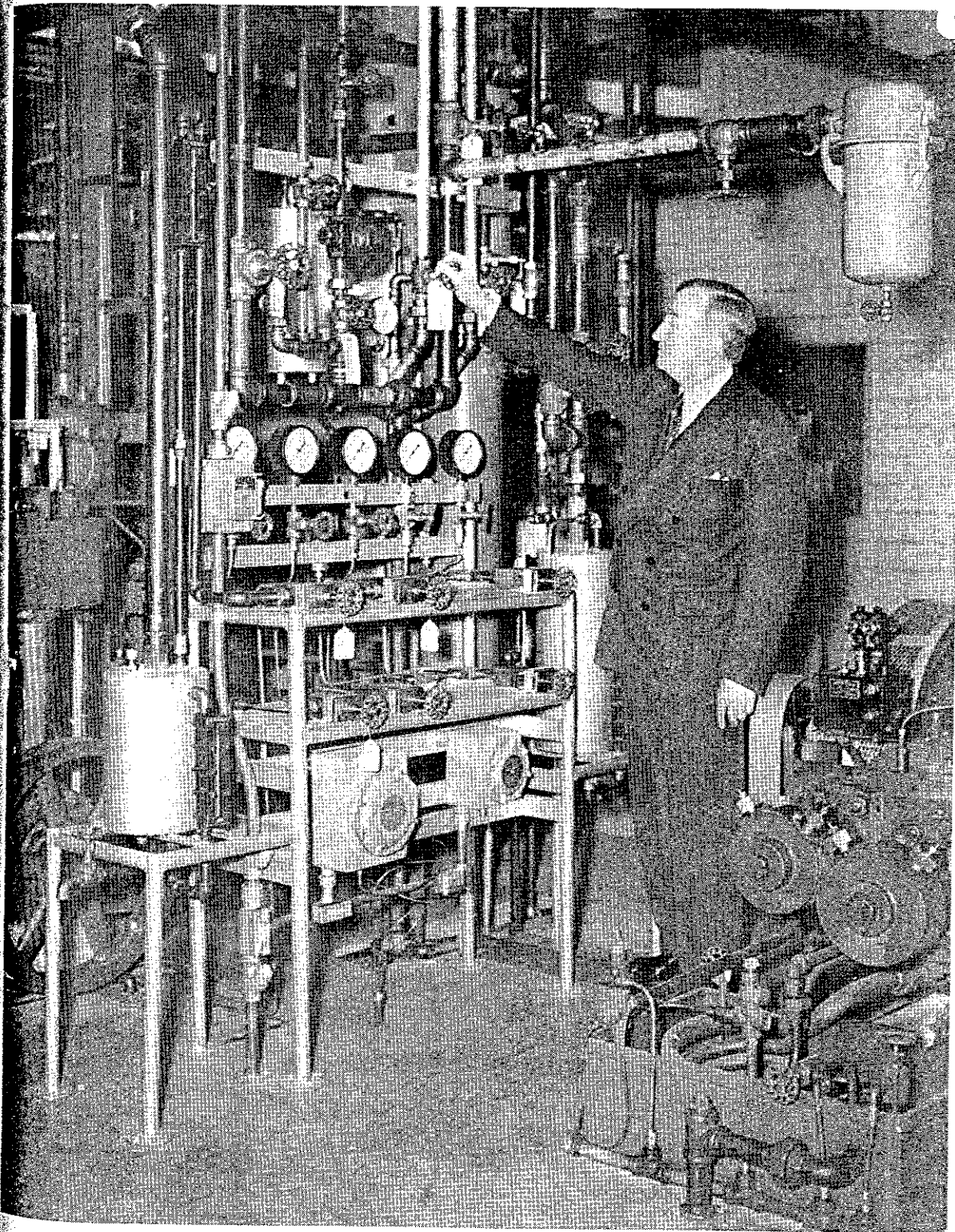


Figure 50. - Hydrogen compressor-valve manifold.

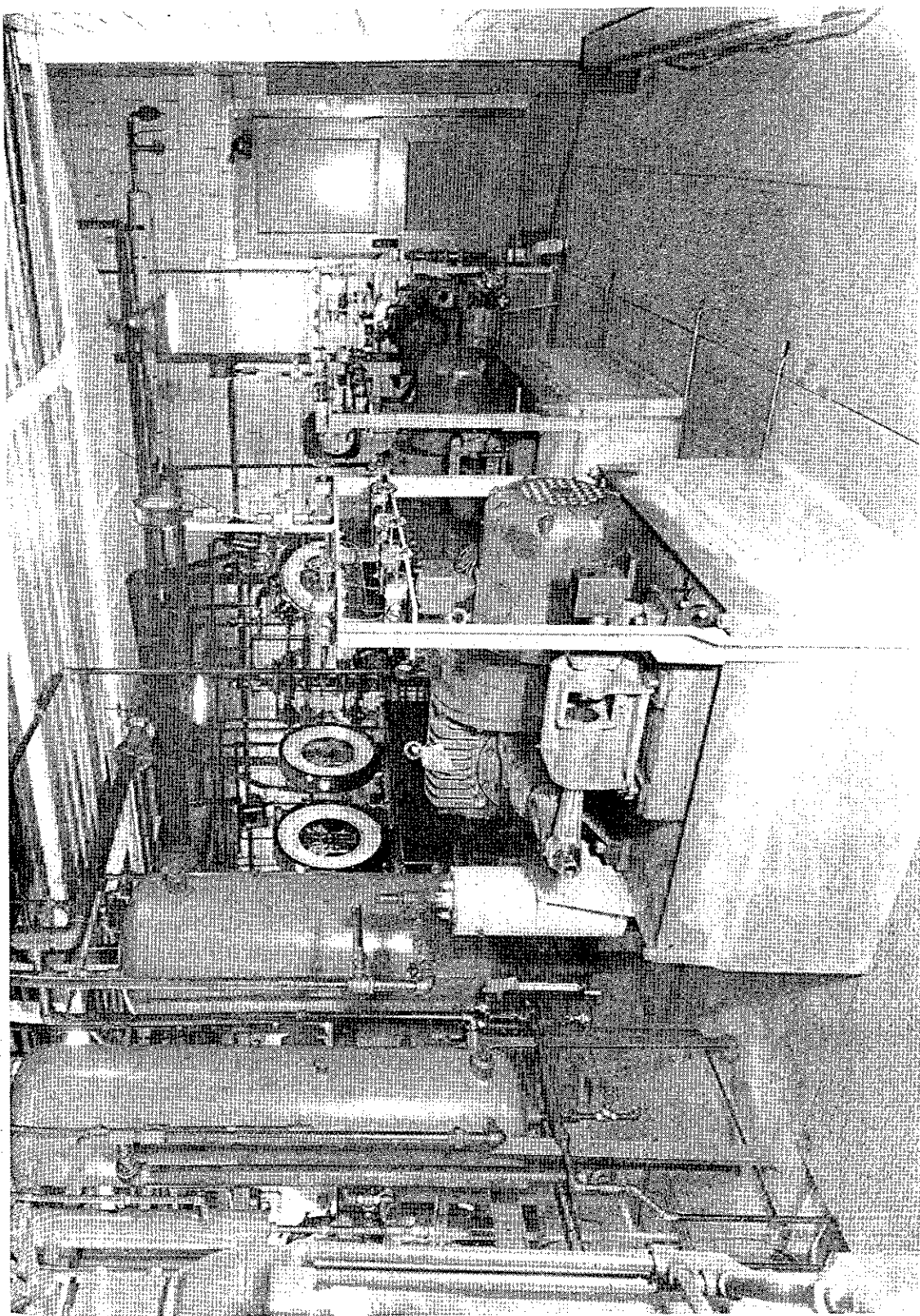


Figure 51. - High-pressure liquid and coal-paste pumps.

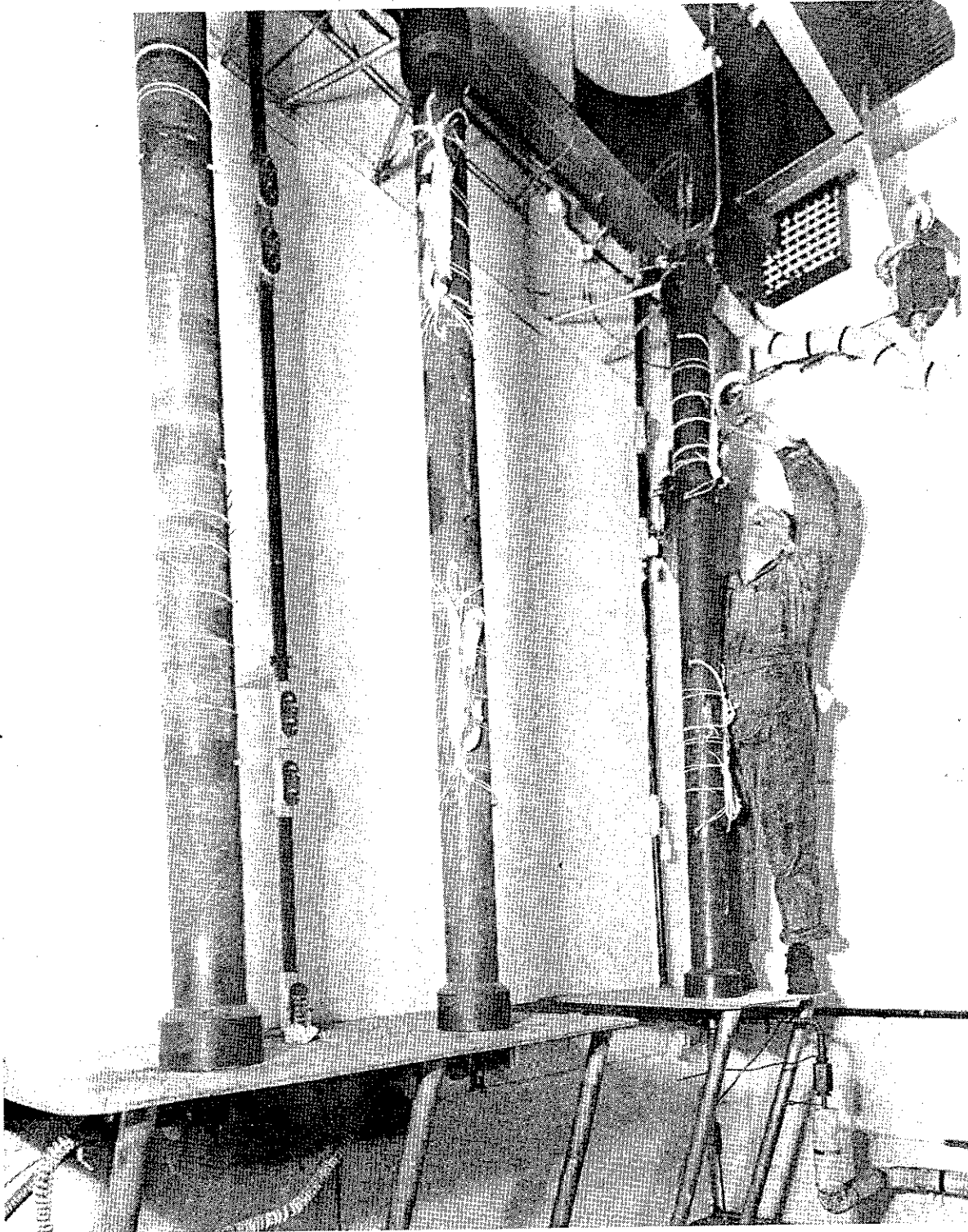


Figure 52. - Liquid-phase coal-hydrogenation reactors.

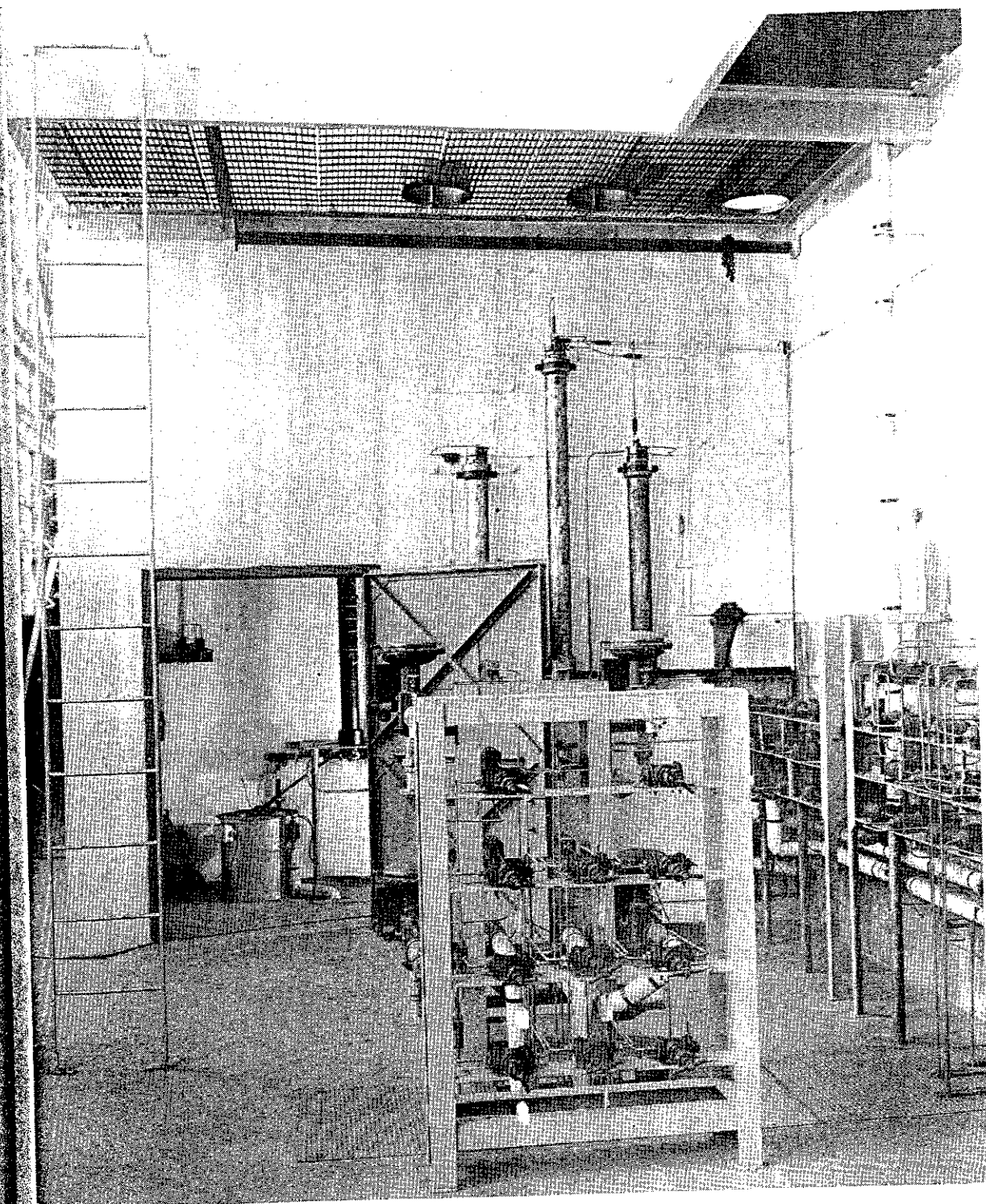


Figure 53. - Coal-hydrogenation liquid-phase plant, showing preheater, feed and product control valves, and off-gas scrubbing vessels.

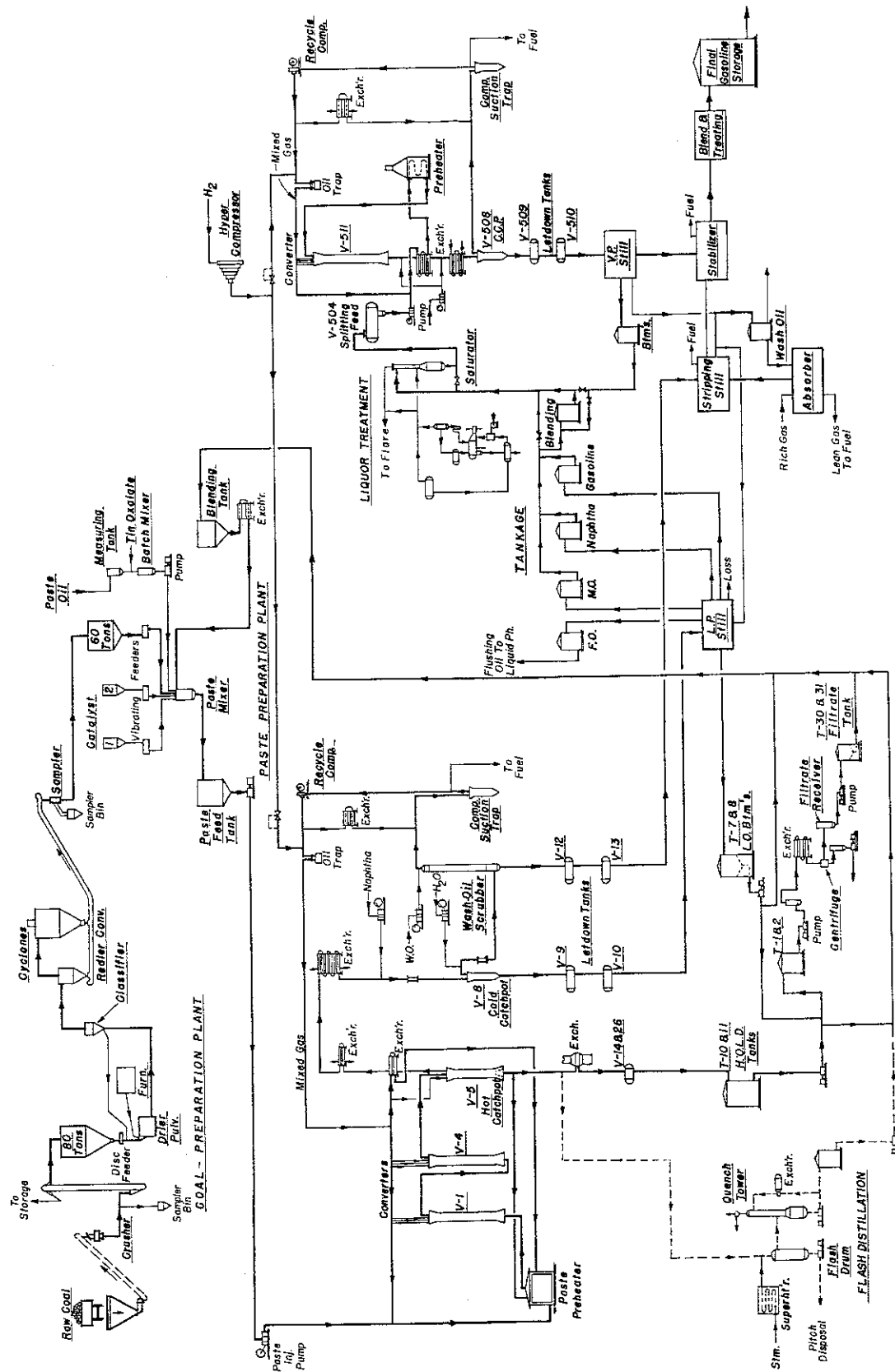


Figure 54. - Coal-hydrogenation process flow diagram.

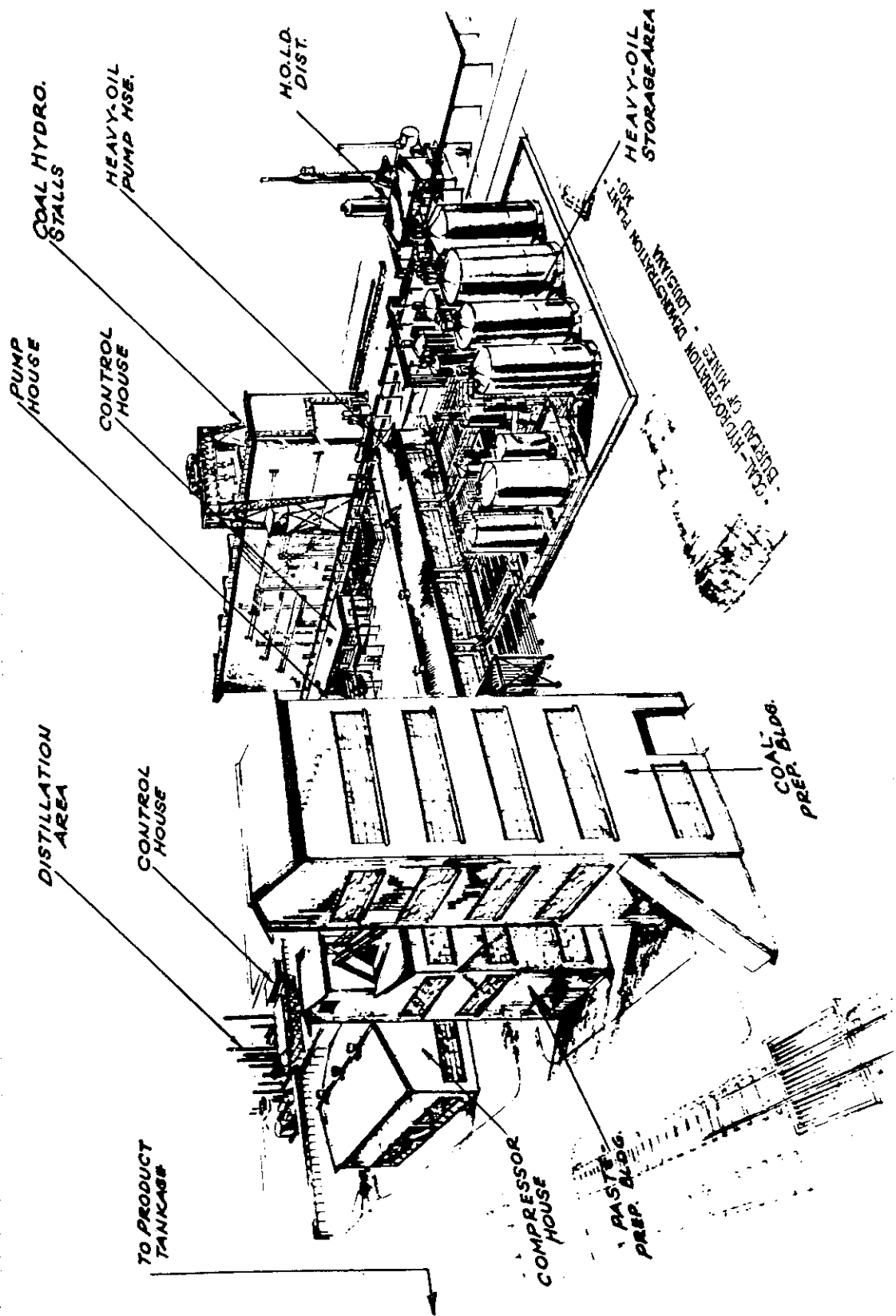


Figure 55. - Sketch of Bureau of Mines Coal-Hydrogenation Demonstration Plant at Louisiana, Mo.

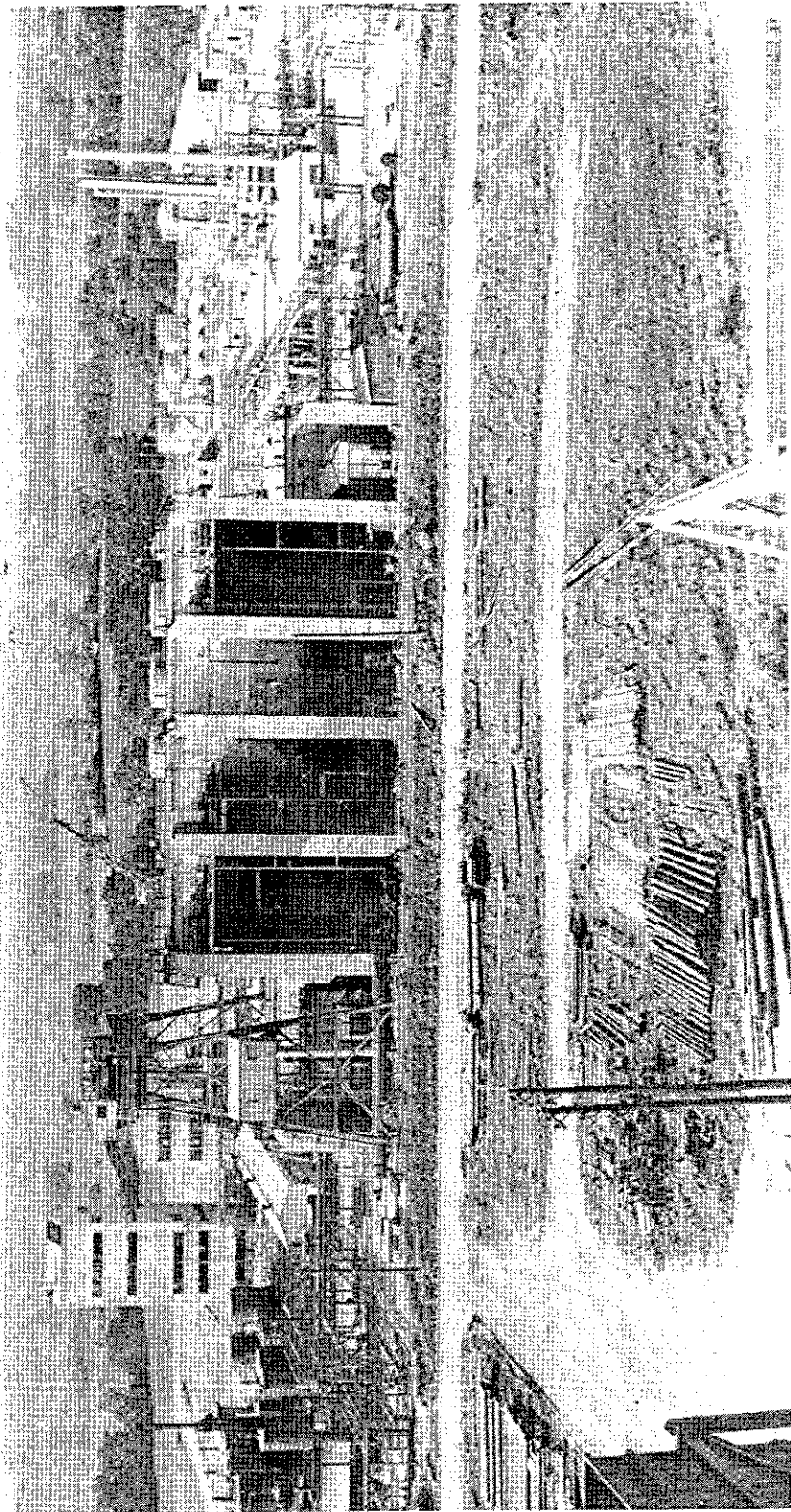


Figure 56. - General view of liquid- and vapor-phase converter stalls.

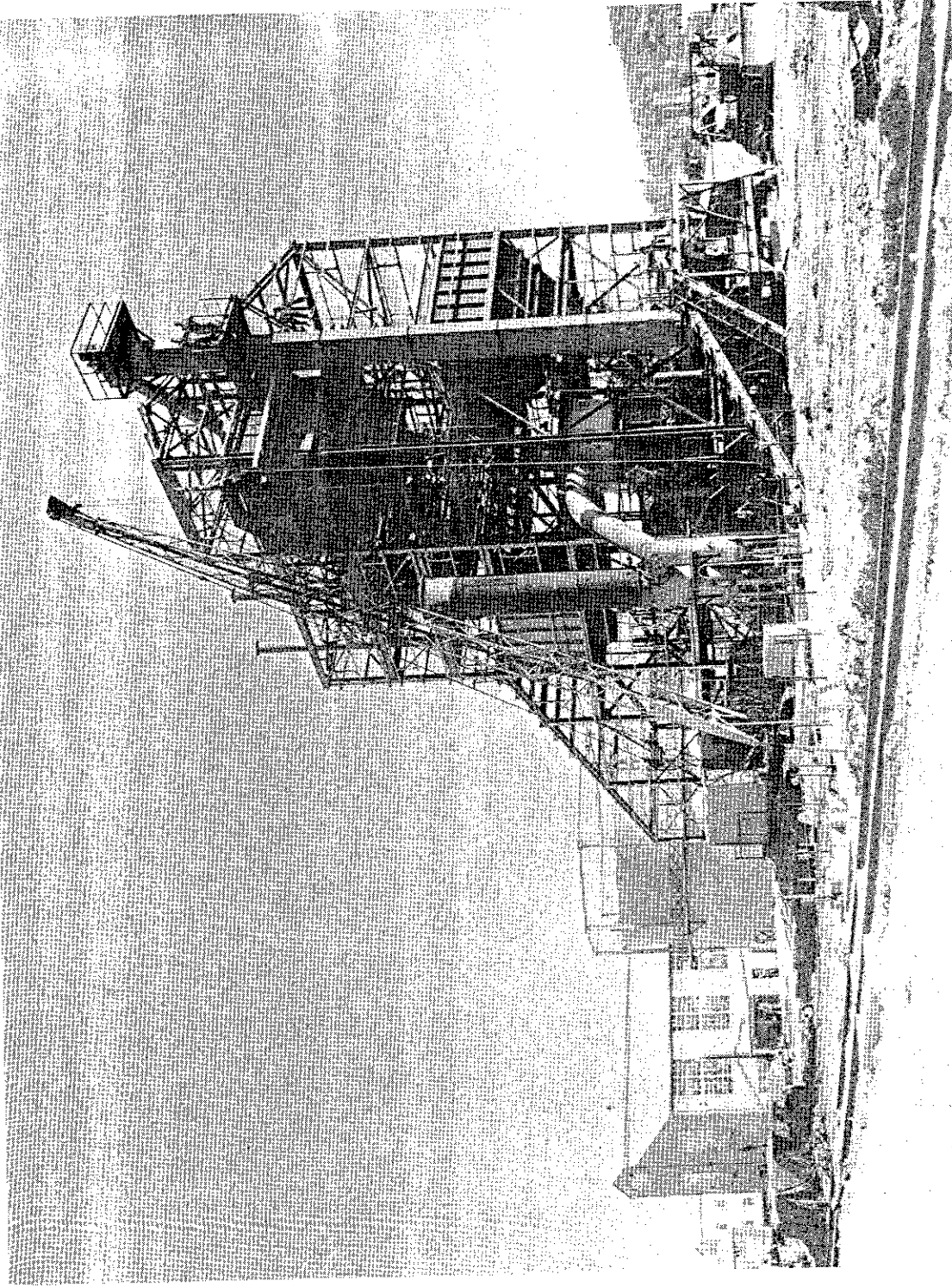


Figure 57. - Coal-gasification building under construction; oxygen building and holder in left background.

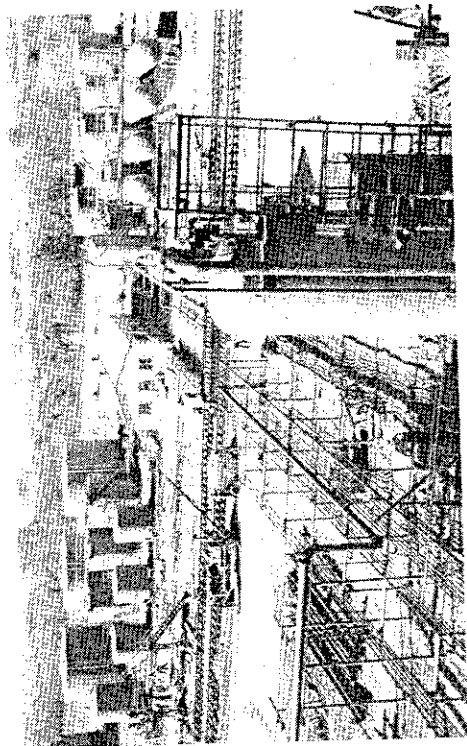


Figure 59. - Storage-tank area and pump house.

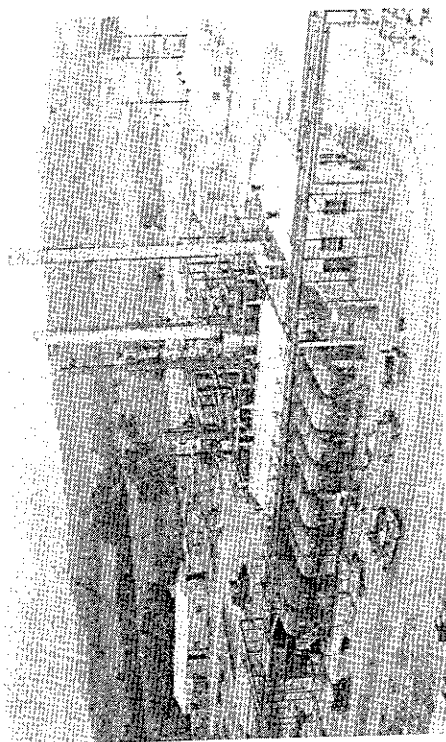


Figure 58. - Distillation plant.

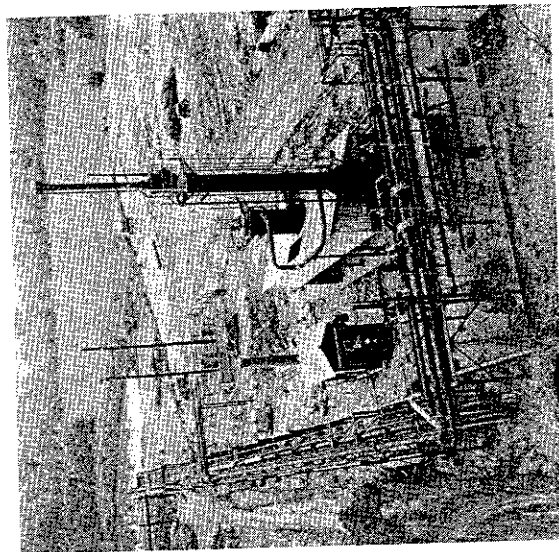


Figure 60. - Heavy-oil let-down flash distillation.

Figure 54 is a simplified process flow diagram of the Coal-Hydrogenation Plant; figure 55 is a perspective sketch of the whole plant; and figure 56 is a general view of liquid- and vapor-phase converter stalls.

Hydrogenation will take place at 700 atmospheres pressure in two major steps: Liquid-phase hydrogenation or liquefaction of coal, and vapor-phase hydrogenation or conversion of the liquefied coal to L.P.G. gasoline and Diesel oil.

Tubing, flanging, fitting, and valving standards were set up for 10,300 p.s.i. working pressure, using different materials for three different temperature groups, ranging from atmospheric to 1,000° F.

Equipment design involved 10,000-p.s.i. pumps, heat exchangers, fired preheaters, and forged converters; and Bureau of Mines engineers brought manufacturers up to date on prevailing Germany practices. Numerous improvements were worked in above the German level of technology such as the superheated steam jacketed paste preheater, added instrumentation regulating liquid levels, flows and pressure drops, and flash distillation of the heavy oil letdown with superheated steam.

The figures 57 through 60 show the plant in the final stages of construction.

Technical Reports and Foreign Document Work

Exhaustive literature and patent surveys on synthetic-liquid-fuel processes have been continued.

Several hundred German patents and applications were received, reviewed, and translated.

The activities of the Synthetic-Liquid-Fuels Foreign Documents Division have been transferred from Washington to Pittsburgh. During the past year, microfilming and collecting of the Technical Oil Mission documents, study reports and translations of captured German documents and papers of the German scientists relating to synthetic liquid fuels have been continued. Files of the above material are being maintained, enlarged, and made available to the general public and to the fuels industry as a reference library.